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THE POPULATIONS OF BOAT-TAILED GRACKLES IN THE SOUTHEASTERN UNITED STATES

Henry M. Stevenson

Abstract.—The Boat-tailed Grackle (*Quiscalus major*) was found to comprise four disjunct and somewhat distinct populations—*Q. m. torreyi*, southern New Jersey to northeastern Florida; *Q. m. westoni*, Florida Peninsula; *Q. m. alabamensis* (described herein), coast of Alabama and southeastern Mississippi; and *Q. m. major*, southwestern Mississippi to southeastern Texas. In the same geographic sequence and in both sexes the iris color of these populations is basically pale, dark, pale, and dark. Other morphological differences are the relative and absolute tail and wing length, the bill proportions, and weight. Fall females of the dark-eyed races (*westoni* and *major*) seem to be more richly colored than are the other two races. Due to the migratory tendency of some individuals, some mingling of subspecies occurs in winter.

The distribution and geographic variation of the Boat-tailed Grackle, (*Quiscalus major* Vieillot) have long been subject to controversy. That some uncertainty still exists is evidenced by the inaccurate description of the range of the species and its races as stated in the latest Checklist of North American Birds (A.O.U. 1957). The stated ranges of the two accepted subspecies, the dark-eyed southern *Q. m. major* and the light-eyed *Q. m. torreyi*, of the middle Atlantic coast, exclude part of the Florida Peninsula (where the species is a common resident) and include the Florida Keys (where there is no verifiable record of the species). Likewise, it is not made clear that any important hiatus exists in the species' breeding range, as is, in fact, the case.

There have been several reasons for such confusion. Field workers generally have not been cognizant of the Boat-tailed Grackle's migrations, with the result that statements regarding the breeding range and eye color of each population may not have been based entirely on breeding individuals. It has been recognized that the population in the middle Atlantic Coast (*Q. m. torreyi*) is migratory to some extent. Although the breeding range extends north to southern New Jersey, many northern individuals retreat in winter at least as far south as coastal Virginia (A.O.U. 1957) or Maryland (Stewart and Robbins, 1958). As to the migration of other populations, the A.O.U. Checklist states only that *Q. m. major* wanders in winter. No mention has been made to the effect that *Q. m. torreyi* winters south of its breeding range. Some Texas birds (*Q. m. major*) reach the Rio Grande in winter (Oberholser, 1974), and many individuals of the

related species, *Quiscalus mexicanus*, also migrate southward in winter (Kincaid, MS). The recognition of these migratory movements is essential to an evaluation of each population's breeding range and physical characteristics.

Although the Boat-tailed Grackle is local in distribution, the extensive gaps in its breeding range have not previously been appreciated. On the east coast of Florida a hiatus of about 55 kilometers occurs between St. Augustine and the mouth of the St. Johns River. In northwest Florida there are no regular breeding or summer records from about St. Vincent Island to the Alabama line, a distance of more than 220 km, and there is not even occasional breeding over 155 km of this distance. On the Mississippi mainland I have found no evidence of breeding between Gautier and St. Louis Bay (Wolf River), which are almost 62 km apart. In each hiatus there are suitable nesting areas. For example, in northwest Florida the upper portions of Choctawhatchee and Escambia Bays have suitable habitat for nesting. Records of Boat-tailed Grackles have been made in fall, winter, or spring in each hiatus, as well as in many other localized areas where they do not regularly occur in summer. In northwest Florida breeding has been reported once near Pensacola (Weston 1965:122)—the only "intimation of probable breeding" in Weston's 48 years of observation—and Panama City, where one breeding record and three summer records are known (Hallman, journal). Since 1957 neither I nor other observers have found the species near Panama City in the breeding season.

As the Boat-tailed Grackle has a breeding range from southern New Jersey to southeastern Texas, at least near the coast, the three hiatuses described above divide the species into four geographically discrete populations (Fig. 2). Within and outside the breeding range of each of the four populations, however, the species is by no means evenly distributed, either geographically or seasonally. I have noticed this uneven distribution in southeastern Louisiana, southwestern Mississippi, coastal Alabama, and northwestern Florida. On the Mississippi coast, Burleigh (1944) saw many birds in fall, late winter, and spring and collected 15 specimens, but recorded the species in summer only at Bay St. Louis. In the Florida Panhandle, Weston (1965), near Pensacola, and Hallman (journal), Bay County, saw the species several times during the non-breeding season. On the south side of Choctawhatchee Bay, Florida, Worthington and Todd (1926:217) collected two males from a flock of 20 birds, "mostly females," on 4 and 5 May 1903, but this fact is not necessarily indicative of breeding there, especially in view of the fact that the flock was "evidently about to go to roost." On several occasions I have seen a few individuals in the first half of May at locations where I knew the species did not nest. Thus the occurrence of the species in winter and spring in areas where it is not known to breed indicates

beyond doubt that populations of Boat-tailed Grackles along the Gulf Coast disperse after the breeding season.

In recent years *Q. m. torreyi* has been found in winter south of its breeding range. Light-eyed birds, usually males, have been reported at Cocoa (Robert Barber, pers. comm.) and Lakeland (John Edscorn, pers. comm.). In 1973 at St. Augustine (about 55 km south of the breeding range of *torreyi*), Geoffrey Carleton (*in litt.*) watched a small group of pale-eyed males, one of which remained as late as 19 March. Carleton and I collected a pale-eyed male there on 4 March 1972 (TT 3282) that was typical of *Q. m. torreyi* in all measurements and ratios. The fact that birds of this race migrate for some distance into Florida may account for earlier statements that adult grackles there have pale irides. However, it seems doubtful that individuals of *Q. m. torreyi* have occurred as far south as Punta Gorda (see Sprunt, 1933 and Pennock, 1931). In any event, no pale-eyed birds are known to breed or summer in Florida south of Duval County.

The question of how long the four breeding populations have been isolated is difficult to answer. In some parts of each hiatus, marshes have been drained or otherwise deleteriously altered, although in each case some suitable habitat still remains. However, I know of no evidence that Boat-tailed Grackles have ever nested in these areas. In the area of Jacksonville, Florida, the hiatus now lies farther south than it formerly did, due to a range expansion of *Q. m. torreyi* and a concurrent range contraction of the Florida form, *Q. m. westoni*. The latter form last nested in Duval County in 1932, and *torreyi* became established there in 1940, with a sporadic nesting in 1931 (Grimes, *in litt.*). With the absence of the species from suitable intermediate areas, gene flow between populations must be constrained, permitting the evolution of populations differing in iris color and other characteristics.

Morphological Methods

In 1965 Frank L. Chapman and I began a study of Boat-tailed Grackles, using specimens borrowed from various museums and collecting additional breeding adults from Florida and Alabama. After Chapman completed his portion of the study (1967), his data were lost in a fire. I resumed the study, collecting in Mississippi and southeastern Louisiana, although Chapman and others took some of the new measurements. Except for specimens collected by Selander and Giller in Texas and Louisiana, most of the labels on specimens taken prior to 1965 did not indicate the bird's weight or its iris color. Thus in each population these characters are represented by fewer individuals than are the measurements.

Except for a few specimens of *Q. m. torreyi* collected in late March, only

specimens taken between 10 April and 10 July were used for morphometric comparisons, as it was assumed that nearly all individuals would be on their breeding grounds during that period. Birds collected within a given 3-month period should also show less variation in weight and measurements than those collected at various times of the year.

Care was taken to eliminate all specimens thought to represent first-year birds. It is not clear whether this procedure was followed in some previous studies of the species (e.g., Sprunt, 1934). Little difficulty was encountered in separating the dull-black younger males from the glossy breeding adults, but distinguishing first-year females from adults is at times difficult.

The following measurements were taken whenever possible: wing length (chord), tail length, bill length from nostril, bill depth at nostril, tarsal length, and, in most specimens, hind-claw length. Birds collected after 1970 were weighed to the nearest gram.

Iris color was recorded for each specimen immediately after collecting. As a rule, I made no distinctions between shades of light or dark, although the color in pale-eyed birds has been variously called white, yellow, cream, straw, lemon, etc. Such fine distinctions can hardly be made in the field, but an attempt to categorize them on a limited basis is described below. Coloration of the plumage was compared among the many specimens collected in spring and early summer. Also, 13 adult females were collected in 1975 and 1977 in order to compare fall plumage coloration among a larger number of fall-collected specimens to be borrowed from museums, but only three such specimens could be obtained.

Univariate comparisons of the means among populations were made by using the Statistical Package for the Social Sciences (SPSS; Nie et al., 1974) program *t*-test. This is a student's *t*-test procedure that produces pooled and separate variance estimates of *t* and an *F*-test for testing for equality of variances among groups. In all cases, groups were found to have equal variances ($P > .05$). Therefore pooled variance estimates of *t* were used.

Discriminant function analyses were used to test the ability of the mensural characters, taken together, to distinguish the populations. The SPSS program DISCRIMINANT was used. A stepwise algorithm that chooses variables so as to maximize D^2 (the Mahalanobis distance) between groups was used. Although differences in color of iris were almost absolute, *no value was entered* to represent this characteristic. (See Table 2.)

Results

Color of iris.—Selander's statement (1958:368) that "iris color is variable geographically . . . and should be carefully investigated" was a cogent observation. Probably the reason its importance had previously escaped attention (or had been misused) was the confusion resulting from erroneous

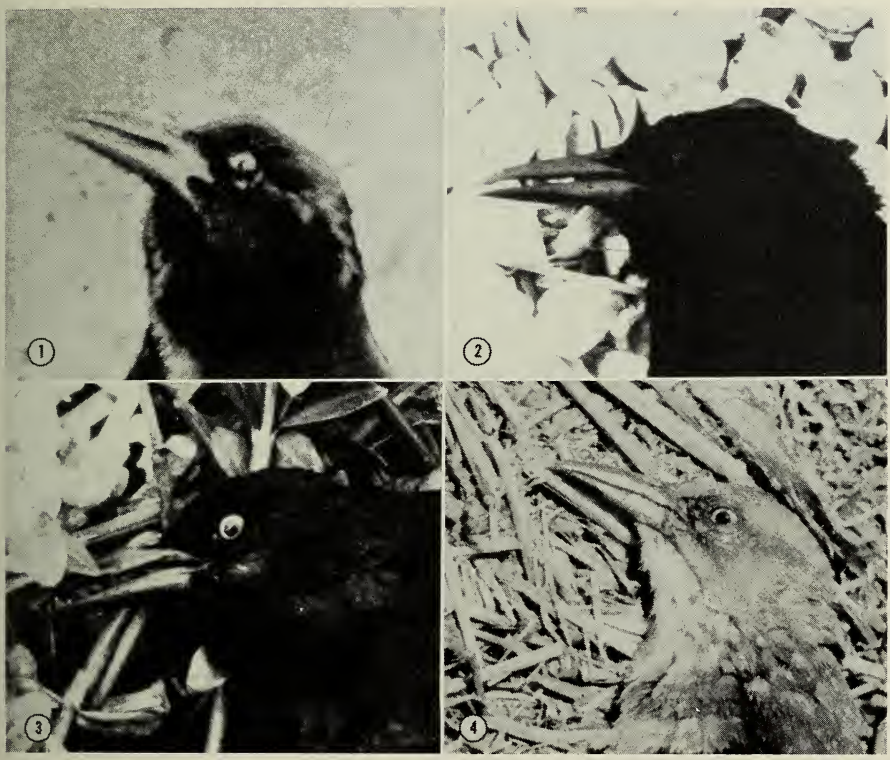

Fig. 1. Iris color of freshly collected Boat-tailed Grackles. 1. Male, *Q. m. torreyi*, Duval County, Fla.; 2. Male, *Q. m. major*, east of New Orleans; 3. Male, *Q. m. alabamensis*, Mobile Bay; 4. Female, *Q. m. alabamensis*, Mobile Bay.

statements about eye color. Some of the bases for such misunderstandings were (1) differences of eye color in adults and first-year birds, (2) examination of wintering individuals rather than those known to breed in the area, (3) light color of the nictitating membrane, which males may draw across the eye for brief periods (Chapman, 1967), (4) temporary contraction of the iris by displaying males (McIlhenny, 1937), (5) light reflection, and (6) confusion with the Common Grackle (*Quiscalus quiscula*). However, when adults were examined during the breeding season, either in life or shortly after collecting, both sexes of each population proved remarkably constant as to iris color, and this color contrasted with that of the adjacent populations as described below.

The marked difference in eye color (Fig. 1) was originally the chief basis for dividing the species into two populations. In fact, however, there are two distinct allopatric populations for each eye color, so that four population units may be separated. These are: pale-eyed birds on the Atlantic

Coast from Duval County, Florida, northward (*Q. m. torreyi*); dark-eyed birds inhabiting the remainder of the Florida Peninsula (*Q. m. westoni*); pale-eyed birds on the coast of Alabama and southeastern Mississippi (described below); and dark-eyed birds along a coastal strip from southwestern Mississippi to southeastern Texas (*Q. m. major*).

Preliminary indications are that the light-eyed and dark-eyed populations may differ in plumage coloration and weight. Most of the 8 females collected in the fall of 1975 and 1977 (5 from the range of *torreyi* and 3 from the breeding grounds of the Alabama form) were paler on the belly, less intensely brownish on the breast, and darker on the head and upper back (with some iridescent greenish on the upper back) than the 3 fall specimens of *Q. m. major* and the 6 specimens of *westoni*, even though some of the latter two groups were collected 5–37 years earlier. In most individuals of the much larger but more worn series collected in the breeding season some indication of these differences remains. The pale-eyed birds also average slightly heavier than the dark-eyed birds (but the sample size is quite small in *torreyi*), and they have thicker bills (ratio of bill depth to bill length; see Table 1).

The subject of eye color in immature Boat-tailed Grackles has been largely ignored, and my collecting efforts have been directed toward adults only. Field observations, as well as the few specimens examined, show that juvenals of all populations have dark irides. Selander (1958) indicated that first-year birds of the normally pale-eyed Great-tailed Grackle, *Quiscalus mexicanus*, are brown-eyed in juvenal plumage, but the eye color changes to yellowish from August to late winter. There is no indication that juvenals of *Q. major torreyi* and the Alabama population transform much later in the season, therefore definitive eye color should be reached in all populations of *Q. major* by the age of 10 months.

Univariate Analyses

Tail/wing ratio.—In general, tail length in *Quiscalus major* increases from east to west, being least in *Q. m. torreyi* and greatest in *Q. m. major*. However, males of the Alabama population have shorter tails than those of *Q. m. westoni*. Relative wing length in the four populations was just the reverse—greatest in *Q. m. torreyi* and least in *Q. m. major*. As a consequence, there was a strong cline in the tail/wing ratio. Measurements, weights, and ratios are summarized in Table 1.

Bill measurements and ratios.—Bill length, in both sexes, is greatest in *westoni* and least in *torreyi*, thus not clinal. Bill depth is clinal in males, being greatest in *torreyi* and least in *major*; in females, the dark-eyed populations have more slender bills than the light-eyed ones. In average ratio of depth to length, both sexes of the pale-eyed populations have higher ratios

Table 1. Summary of measurements, ratios, and standard deviations in four populations of adult Boat-tailed Grackles.

Males	*torreyi* (22)			*westoni* (47)			*alabamensis* (16)			*major* (55)		
	Range	mean	SD	Range	mean	SD	Range	mean	SD	Range	mean	SD
Tail length	147–175	(163.5)	7.94	151–181	(169.6)	7.31	153–179	(167.3)	6.93	155–194	(174.3)	7.91
Wing length	176–192	(181.2)	3.88	171–188	(180.4)	3.48	169–191	(177.3)	5.63	165–188	(175.6)	6.15
Tail/wing	.821–.966	(.902)	.040	.854–.989	(.939)	.032	.895–1.017	(.944)	.032	.904–1.078	(.991)	.038
Bill length	26.2–35.1	(29.82)	1.92	29.4–36.5	(32.47)	1.82	28.8–32.3	(30.48)	1.05	28.0–34.0	(31.18)	1.34
Bill depth	11.5–13.5	(12.71)	0.55	11.5–13.6	(12.56)	0.62	11.6–12.9	(12.38)	0.43	10.5–13.8	(12.25)	0.66
Bill ratio	.356–.459	(.428)	.026	.348–.432	(.387)	.024	.385–.448	(.406)	.020	.355–.450	(.398)	.022

Females	*torreyi* (19)			*westoni* (40)			*alabamensis* (16)			*major* (33)		
	Range	mean	SD	Range	mean	SD	Range	mean	SD	Range	mean	SD
Tail length	109–124	(118.7)	4.83	109–135	(119.6)	5.66	109–130	(121.9)	5.84	107–131	(121.3)	6.15
Wing length	131–146	(140.8)	3.58	132–147	(138.3)	3.79	130–143	(137.3)	3.46	130–148	(136.4)	4.46
Tail/wing	.787–.898	(.843)	.026	.807–.926	(.867)	.032	.826–.928	(.887)	.028	.811–.956	(.890)	.036
Bill length	22.3–25.8	(23.92)	1.07	22.8–27.7	(25.20)	1.40	23.2–25.3	(24.26)	0.67	23.2–27.5	(25.28)	1.00
Bill depth	9.7–11.5	(10.67)	0.51	9.4–11.1	(10.08)	0.36	9.7–11.3	(10.28)	0.39	9.6–10.6	(10.11)	0.30
Bill ratio	.404–.483	(.447)	.026	.365–.435	(.401)	.020	.391–.473	(.424)	.022	.358–.436	(.400)	.018

Table 2. Summary of discriminant function analyses.

Populations included	Variable	Step no.	F to enter	Discriminant function coefficients 1	2
all four, males	tail length	1	11.75122	–1.09555	.12502
	wing length	2	33.45797	1.14180	–.15146
	culmen length	3	15.99598	–.27810	–1.21348
	culmen depth	4	2.97251	.30216	.29712
all four, females	tail length	1	5.40081	–.61385	.97113
	wing length	2	7.60103	.80849	–.93508
	culmen length	3	10.57092	–.72260	–.61218
	culmen depth	4	13.81670	.85964	.38576
pale-eyed males	tail length	1	6.67007	1.01094	
	wing length	2	7.88684	–.72892	
	culmen length	3	3.85469	–.60190	
	culmen depth	4	2.70515	.47134	
pale-eyed females	tail length	1	8.71016	–1.24585	
	wing length	2	26.85724	1.49316	
	culmen length	3	3.02168	.41996	
	culmen depth	4	.67485	–.20151	
dark-eyed males	tail length	1	32.98015	–1.08357	
	wing length	2	43.20331	.95050	
	culmen length	3	10.18270	–.48391	
	culmen depth	4	.02125	–.02267	
dark-eyed females	tail length	1	4.00067	1.18172	
	wing length	2	8.02715	–1.00978	
	culmen length	3	.11138	–.12477	
	culmen depth	4	.02706	.05763	

than those of the dark-eyed populations, with *torreyi* considerably higher than the Alabama birds (Table 1).

Tarsal length.—Although mean length of tarsus in each sample tended to vary with over-all size, there were many exceptions. As the taking of this measurement is more subject to error than some others, I am not sufficiently confident of the results to use them in separating populations.

Student's t-*test.*—The results of these tests appear in Table 3, showing one or more significant differences ($P = < .05$) between any two populations (both sexes). The least significant of these is wing length among dark-eyed females ($P = .049$), but dark-eyed males differed significantly in all four measurements ($P = 0.001$–0.18).

Table 3. Significant *P*-values obtained from *t*-tests among four populations of *Quiscalus major* (BL, bill length; BD, bill depth).

Population	*torreyi*		*westoni*		*alabamensis*	
Males						
Q. m. westoni	tail	.003				
	BL	<.001				
Q. m. alabamensis	wing	.014	wing	.010		
	BD	.001	BL	<.001		
Q. m. major	tail	.001	tail	.003	tail	.002
	wing	.001	wing	<.001		
	BL	.010	BL	<.001		
	BD	.005	BD	.018		
	westoni		*alabamensis*		*major*	
Females						
Q. m. torreyi	wing	.019	wing	.006	wing	.001
	BL	.001	BD	.017	BL	<.001
	BD	<.001			BD	<.001
Q. m. westoni			BL	.013	wing	.049
Q. m. alabamensis					BL	.001

Multivariate Analyses

Discriminant function analyses.—The first analyses compared all four geographic groups, analyzing males and females separately, as to wing length, tail length, bill length, and bill depth (Table 2). The results of these analyses appear in Table 4 and are based on the same individuals that appear in Table 1. With similar sample sizes, and based on chance alone, such a test should place only 25% of the individuals in any given population, but sample size varied from 16–55. In all four races, the computer correctly assigned more than 60% of the males to the population from which they came. The "correct" assignment of females was more than 80% in *Q. m. torreyi* and more than 40% in each of the other 3 races. More females of each population were referred to the "right" population than to any of the other 3 populations.

Two other analyses were used to determine the degrees of difference between geographically disjunct populations with similar eye color. The same four measurements were entered separately for each sex of *Q. m. torreyi* and the Alabama population, then for *Q. m. westoni* and *major*. In the pale-eyed populations (Table 5) more than 85% of the individuals in

Table 4. Reclassification section of discriminant function analysis of four populations of *Quiscalus major*, based on wing, tail, and bill measurements.

	torreyi	*westoni*	*alabamensis*	*major*	Scored "right"
Males					
Q. m. torreyi	*17* (77.3%)	2 (9.1%)	3 (13.6%)	0 (0.0%)	17/22
Q. m. westoni	5 (10.6%)	*31* (66.0%)	8 (17.0%)	3 (6.4%)	31/47
Q. m. alabamensis	2 (12.5%)	2 (12.5%)	*10* (62.5%)	2 (12.5%)	10/16
Q. m. major	1 (1.8%)	5 (9.1%)	8 (14.5%)	*41* (74.5%)	41/55
Females					
Q. m. torreyi	*16* (84.2%)	2 (10.5%)	1 (5.3%)	0 (0.0%)	16/19
Q. m. westoni	3 (7.5%)	*17* (42.5%)	8 (20.0%)	12 (30.0%)	17/40
Q. m. alabamensis	3 (18.8%)	2 (12.5%)	7 (43.8%)	4 (25.0%)	7/16
Q. m. major	1 (3.0%)	6 (18.2%)	9 (27.3%)	*17* (51.5%)	17/33

each sex were scored "right" except for males of *torreyi* (81.8%). In the dark-eyed races (Table 6) more than 80% of the males were correctly assigned, but among females only about 65–70% were referred to the group from which they came.

Another discriminant function analysis added weights to the measurements previously compared among dark-eyed populations. Although the number of weighed individuals of *westoni* was relatively small, the results probably indicate a true difference among males. Among females, 11 of 15 *westoni* (73.3%) and 24 of 27 *major* (88.9%) were correctly placed. However, all but 3 specimens of *major* were collected late in the breeding season (2–10 June) and were probably underweight. Even so, the 6 females of *westoni* that were collected in June and July averaged slightly heavier than those of *major*. Among males no such disparity in dates of collection existed, as no weighed specimens of either population were collected earlier than June. Yet the average difference in weight was just as great as among females, and the computer referred all 10 specimens of *westoni* correctly and 30 of 31 *major* (96.8%).

Table 5. Reclassification section of discriminant function analysis of light-eyed populations of *Quiscalus major*, based on wing, tail, and bill measurements.

	torreyi		*alabamensis*		Scored "right"
Population	males	females	males	females	(both sexes)
Q. m. torreyi	*18* (81.8%)	*17* (89.5%)	4 (18.2%)	2 (10.5%)	35/41 (85.4%)
Q. m. alabamensis	2 (12.5%)	2 (12.5%)	*14* (87.5%)	*14* (87.5%)	28/32 (87.5%)

Table 6. Reclassification section of discriminant function analysis of dark-eyed populations of *Quiscalus major*, based on wing, tail, and bill measurements.

Population	*westoni*		*major*		Scored "right"
	males	females	males	females	(both sexes)
Q. m. westoni	*41* (87.2%)	*27* (67.5%)	6 (12.8%)	13 (32.5%)	68/87 (78.2%)
Q. m. major	9 (16.4%)	10 (30.6%)	*46* (83.6%)	*23* (69.7%)	69/88 (78.4%)

Quiscalus major torreyi Harper

Francis Harper (1934) correctly described the population along the Atlantic Coast north of Florida as differing from others of the species in having a longer wing and a "pale yellow iris." Adult males were said to be "more uniform" in the color of the back, breast, and abdomen than those of other populations, but I have been unable to substantiate this. Wing length was said to average more than 180 mm in males and more than 140 in females. Although I have not seen the type specimen (ANSP 101543), from Chincoteague, Virginia, Harper's measurements of it are well within the extremes of that population. In addition to iris color, *Q. m. torreyi* is best separated from other races by a low tail/wing ratio and a high ratio of bill depth to bill length (Fig. 7; Table 1; also note thicker bill in Fig. 3). The former ratio is somewhat clinal, averaging higher in birds from South Carolina southward.

Harper gave no indication of the number of localities from which other specimens were examined, the seasons in which they were collected, or the range of variation in *Q. m. torreyi*, but the means he gave agree well with those I obtained. The range of the subspecies was said to extend southward "to southern Florida," including "Collier County" (Gulf Coast), but without reference to time of year. Duval County, Florida, however, is presently its southern breeding limit. It is doubtful whether this form reaches south Florida even in winter. Sight records of pale-eyed birds farther south in winter could probably represent either of the pale-eyed populations. Harper's erroneous range statement was based on reports of pale-eyed birds in south Florida by Sprunt (1932, 1933) and Pennock (1931). Samuel Grimes (*in litt.*) has indicated that this pale-eyed form extended its southern breeding limit southward from Nassau County to Duval County around 1940, and these are still the only Florida counties in which it is known to breed or summer. It is virtually restricted to the coast throughout its range, but Burleigh (1958) mentioned reports of breeding in inland Brantley County, Georgia, and in the Okefenokee Swamp. Eugene Cypert (*in litt.*), however, worked in the Okefenokee National

Fig. 2. Distribution of the populations of *Quiscalus major* in relation to the average minimum temperature for 21–27 May (Visher, 1954; Fig. 132).

Wildlife Refuge for years without ever encountering Boat-tailed Grackles. It is possible that such inland breeding records, if valid, may represent the dark-eyed Florida population.

Quiscalus major westoni Sprunt

The original description of this form (Sprunt, 1934) has not been widely accepted, probably because of several shortcomings in the diagnosis. In fact, the describer himself (Sprunt, *in* Bent 1958) later included the race in *Q. m. major*. Even though the type specimen (CH 256, formerly 34.86.1, a male from the St. Johns River marshes, Indian River Co., Fla.) was collected in winter, thus could have been a migrant, the fact that it had dark irides virtually eliminates the possibility that it belonged to a more northern population. Furthermore, my measurements of the specimen indicate a typical Florida bird. As my measurements (and those of Albert Sanders for the hind claws) differ from those cited by Sprunt, they are given here (mm): wing, 170; tail, 182; tarsus, 53; exposed culmen, 43; depth of bill at nostril, 12.0; bill width, 9.3; hind claw, 17.2. In tail/wing ratio (.934) the type specimen is very close to the average for males of *westoni* (.939). Sprunt also characterized *westoni* as having a "longer and more slender bill," and it would be difficult to find a more striking example of that combination than the type-specimen. In length from nostril, its 36.9 mm is by far the greatest of any specimen I examined, and the ratio of depth to length (.325) is the lowest of any (see Fig. 3). Correspondingly, the

Fig. 3. Comparative bill dimensions in *Q. m. torreyi* (right) and *Q. m. westoni*, type specimen (left); both specimens in Charleston Museum.

lowest ratio for a male of *torreyi* was .359. These same dimensions, ratios, and eye color also indicate that the bird was not a stray from Alabama. There is, in fact, no evidence that other races of Boat-tailed Grackles migrate as far south in Florida as the type locality of *westoni*.

Sprunt listed one characteristic of *Q. m. westoni* as "claws longer," citing measurements for the hind claw and middle claw of *westoni* and "*major*." I did not find this a useful character. There is considerable individual variation in claw length within each population, the shorter claws being blunt and the longer ones sharp, strongly suggesting differential wear. Hind-claw length can hardly be considered a reliable criterion for any race of Boat-tailed Grackles.

With light-eyed populations occurring both to the north and to the west, the best characteristic of *Q. m. westoni* is the almost invariably dark irides of adults. Every individual of *westoni* I have observed in the field showed only dark pigment in the iris. Chapman, however, collected one (FSU 6860.lae) at Lake Panasoffkee, Sumter County, on 11 May 1967, and indicated on the label that the iris had a light periphery, but I had no opportunity to examine it. During the debate regarding the eye color of Florida's breeding Boat-tailed Grackles, observers who agreed that it was always dark were Brooks (1928 and 1932), Townsend (1931), Nicholson (1932), and Shannon (1934). Sprunt, after describing (1933) an anomalous distribution of coastal "yellow-eyed males" and inland "brown-eyed females" in the Florida Peninsula in February and March 1932, modified the statement later. In his description of *Q. m. westoni*, Sprunt (1934) made no reference to light-eyed birds in Florida but stated that "*major*" occurred along the

coast in winter. Assertions by others (Pennock, 1931; Bailey, *in* Sprunt, 1932) that Florida's *breeding* birds had pale irides are perhaps best attributed to faulty memory. The extent to which pale-eyed birds of other races winter in Florida is still uncertain. I have rarely seen light-eyed birds in the field south of the known range of *torreyi*, but most of my work in the Peninsula has been done in summer. It seems unlikely that individuals of the pale-eyed populations would reach south Florida.

There have been some changes in the known range of *westoni* since 1939. On the Atlantic Coast, where it formerly nested north to the mouth of the St. Johns River (Grimes, *in litt.*, 17 March 1975), it now is unknown north of St. Augustine. The western limit at which dark-eyed birds are known to breed is St. Vincent Island, Franklin County. They also breed regularly in the interior as far north as Lake City and, at least occasionally, ENE of Live Oak, Suwannee County, where I found a family group within 33 km of the Georgia line, 9 July 1971, and collected an adult female (Ogden, 1971). Dark-eyed grackles occasionally reach the Tallahassee area, and one pair nested at Lake Jackson, Leon County, in 1959 (juvenal collected; Stevenson, 1959). Other records in that part of the state have involved only males and range from March to November. Eye color was not recorded for single birds near Thomasville, Georgia (55 km NE of Tallahassee), on 15 August 1959, 15 December 1964, and 26 December 1971 (Crawford and Dozier, 1973). West of Tallahassee there seem to be no inland records of this grackle.

Although the occurrence of Boat-tailed Grackles on the Florida Keys has not been proven, an occassional stray in winter seems likely. J. W. Atkins reported "a few stragglers" at Key West in September and October, 1887–88 (Scott, 1889:321), and Brodhead (1910) reported the species on the Keys "in March." Fowler (1906), however, under the heading of "*Quiscalus major.* Black Bird," stated that "several brown birds [females], apparently this species, were seen on Summerland Key in *June* 1904" (italics mine). Howell (1932:432) apparently had no personal records from the Keys, but stated, without reference to season, that this grackle was "reported from most of the Keys as far south as Key West." It is almost certain that the species has not occurred on the Keys during the breeding season in recent years. On the lower Keys, Greene (1946) had no record at any time of the year, and Hundley and Hames (1962:80) referred only to Howell's (1932) statement. The species has not been listed on any Christmas Bird Count on the Keys (Key Largo to Key West).

Quiscalus major alabamensis subsp. nov.

Holotype.—Adult male (USNM 567736); Baldwin County, Alabama (upper Mobile Bay), 4.5 km E of Mobile, 21 April 1971; Henry M. Stevenson; original number FSU 6860.3i.

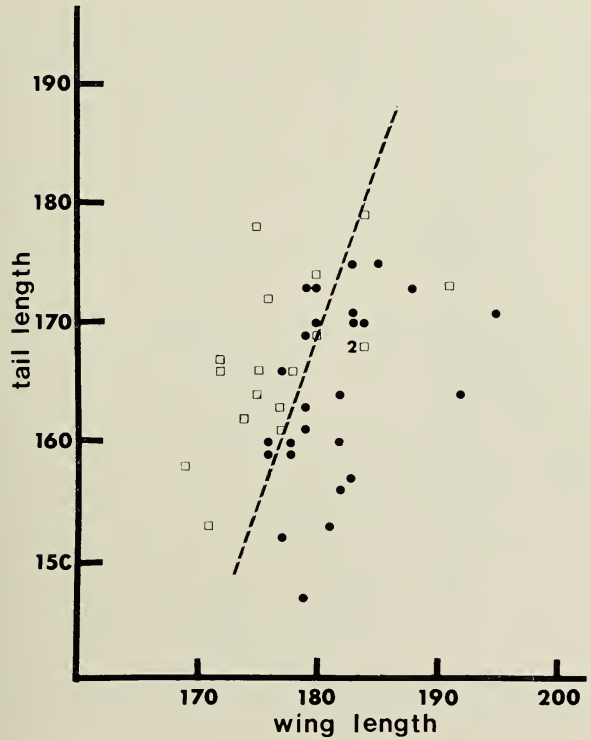

Fig. 4. Wing and tail lengths of males of *Q. m. torreyi* (●) and *Q. m. alabamensis* (□). The numeral 2 represents two specimens of *torreyi*.

Measurements of holotype.—Tail, 174 mm; wing, 180; exposed culmen, 37; bill length from anterior margin of nostril, 28.8; bill depth at mid-nostril, 12.5; bill width at mid-nostril, 9.2; tarsus, 49; hind claw (straight line from dorsal insertion), 15.6; weight, 206 g.

Allotype.—Adult female (USNM 567737); same collection data as for holotype; original number, FSU 6860.3m.

Diagnosis.—Plumage coloration of males as in other populations, of females close to that of *Q. m. torreyi.* Iris mostly pale (cream, straw, or yellowish), but with a narrow, dark margin around pupil. Tail length 89–102% of wing length in males (.934), 82–93% in females (.888). Bill deeper than in *Q. m. westoni* and *Q. m. major*, but not as deep as in *Q. m. torreyi* (depth at center of nostril .385–.448 of length from nostril in males, mean .408; .391–.473 in females, mean .424). Averaging heavier than *Q. m. westoni* and *Q. m. major*—males 187–238 g (207.8), females 96–123 g (97.9). Similar in size to *Q. m. torreyi*, but differing in a slightly smaller depth-to-length ratio of bill and a larger tail/wing ratio (Table 1 and Figs. 4 & 5). Chapman

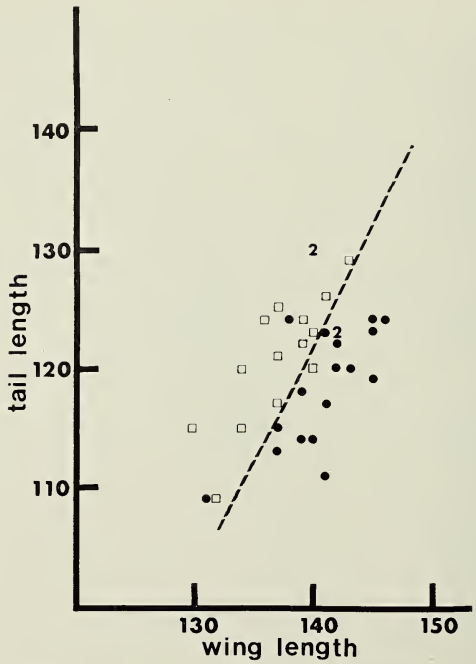

Fig. 5. Wing and tail lengths in females of *Q. m. torreyi* (●) and *Q. m. alabamensis* (□). Numbers refer to specimens of *torreyi* (right of line) and *alabamensis* (left of line).

(1967) included this population with *Q. m. major* and did not examine specimens from west of Mississippi. (See also Taxonomic Status.)

Measurements.—Adult males (17): tail, 153–179 (167.0) mm; wing, 169–191 (177.1); bill length from nostril, 28.8–32.3 (30.48); bill depth at nostril, 11.6–13.5 (12.44); tarsus, 48–52 (50.0). Adult females (16): tail, 109–130 (121.9); wing, 130–143 (137.3); bill from nostril, 23.2–25.3 (24.26): bill depth at nostril, 9.7–11.3 (10.28); tarsus, 40–43 (40.9).

Distribution.—Resident along the coast of the mainland of Alabama and Mississippi west to Gautier, Jackson County, Mississippi; most abundant in upper Mobile Bay; also present on Horn Island, Mississippi, and probably on Petit Bois Island, Alabama; probably wanders to NW Florida and has nested there sporadically. Status on other Mississippi islands uncertain.

Adult specimens examined (breeding season).—Alabama: upper Mobile Bay, 22; "Mobile Bay," 2; Alabama Port, 1; Florida Point, 1. Mississippi: Gautier, 4; Horn Island, 3.

Remarks.—Grackles nesting along the mainland coast of Alabama to the Pascagoula area and Horn Island in Mississippi are isolated from other breeding populations. They differ from the closest breeding populations to the east and to the west in iris color, which is dark in *Q. m. westoni*

and *Q. m. major*. In *alabamensis* the iris of adults is almost invariably pale, both as it appears in the field and in the hand, because the light periphery of the iris is wider than in *major* (in which it is often lacking). Only near Pascagoula and on Horn Island, where the population comes closest to dark-eyed *major* (about 62 km to the west), were partial exceptions noted. One of 4 specimens collected near Pascagoula had yellowish brown irides, and one of 2 collected on Horn Island had dark flecks in the otherwise pale irides. Four specimens collected by others in the range of *alabamensis* had no indication of iris color on the labels, but all of the remaining specimens were pale-eyed.

West of Alabama, Burleigh (1944) collected Boat-tailed Grackles on the Mississippi coast and islands, both in the breeding range of *alabamensis* and in that of *major*. He informed me (*in litt.*, 7 August 1972) that all specimens he handled were dark-eyed, but the only one collected during the breeding season (6 June 1936, Bay St. Louis) was in the breeding range of *major*. Boat-tailed Grackles nest on Petit Bois Island, Alabama (Howell, 1924) and apparently on certain islands off Mississippi. The 3 adults I have examined from Horn Island have measurements and ratios somewhat intermediate between those of *major* and of *alabamensis*. I think it probable that any Boat-tailed Grackles nesting on Horn and Petit Bois Islands will prove referable to *alabamensis*, but the identity of any that may nest on Cat and Ship Islands, Mississippi, is conjectural.

On 22 April 1974 Melford Smith and I searched the Mississippi mainland between Gautier and St. Louis Bay in areas apparently suitable for Boat-tailed Grackles and saw only one wary female near Ocean Springs, possibly a late migrant. None was found on Deer Island, but we did not visit the more distant islands. I doubt that the species breeds regularly or frequently in this mainland hiatus, even though Smith (*in litt.*, 18 Feb. 1975) noted single birds at Ocean Springs on 9 May and 1 June 1974.

Because *Q. m. torreyi* and *Q. m. alabamensis* are similar to *Q. mexicanus* in size and iris color, the question of their degree of relationship to that species might well be raised. Everything I have observed of their courtship displays, nesting habits and habitat, and vocalizations, however, leads me to consider them typical of *Quiscalus major*. Although my ear is more discriminating than that of many observers, and I am more impressed by the differences than the similarities in the vocalizations of *major* and *mexicanus*, I have noted no differences in voice among the various populations of *Q. major*.

Quiscalus major major Vieillot

As the type specimen of this race was collected in Louisiana (New Orleans?) in May, it may be assumed that it represented the race now breeding there. Measurements obtained by Chapman and me agree well

with those made by Lowery (1938) and by Selander and Giller (1961) for portions of this population. The iris of specimens I collected at the eastern edge of the range (Orleans Parish, La.; Harrison Co., Miss.) appeared dark both in the field and in the hand, although surrounded by a narrow periphery of gold. This eye color is in keeping with that described by the authors listed above, and its range of variation has been depicted by Pratt (1974). The iris never shows as much light color as Pratt's figures of the Great-tailed Grackle (*Q. mexicanus*) nor as much as the specimens of *Q. major alabamensis* or *Q. m. torreyi* that I have seen. Thus Sprunt's statement (1934:3,5) that the population in Louisiana and Texas was "yellowed-eyed" is in error.

Of all the races of Boat-tailed Grackles, *Q. m. major* has the longest tail and largest tail/wing ratio. The latter value showed a mean of .991 in males and of .893 in females. Corresponding ratios obtained by Lowery (1938) in the New Orleans area were 1.000 and .939. Only 2 males of any other races attained a ratio as high as 1.000. In any case, this value averages higher than 1.000 in Texas males and decreases clinally in that sex from west to east.

Both sexes of *Q. m. major* resemble *westoni* in having a more slender bill than do the pale-eyed races, but the difference in males of *major* vs. *alabamensis* (.395 and .408) is slight.

Q. m. major weighs less than the other populations. The weights of males recorded on Selander and Giller's museum labels are very similar to those I obtained, but the females I collected were heavier. This difference may have been due either to the small size of my sample, the early dates of collections (April), or may represent an east-west cline, as mine were collected east of the Mississippi River. In any case, the small size of the Texas birds, especially, may serve as a character reinforcement where they are sympatric with the larger *Quiscalus mexicanus*.

Records in the Florida Panhandle

Observers who have seen Boat-tailed Grackles occasionally in northwest Florida, where the species has rarely nested, include Weston (1965), Hallman (journal), H. and A. Gaither (Purrington, 1970), and Stephen Stedman (pers. comm.). Of these, only Hallman referred to eye color ("males with light eyes" on four dates ranging from 9 February to 13 October). Hallman made no mention of eye color in females. Other writers, in fact, have implied that pale irides occur only in males. Females of the same races, however, also have a pale iris, but it is less conspicuous in the field than that of males.

Farther east, in the range of *westoni*, light-eyed Boat-tailed Grackles sometimes appear in the nonbreeding season. Few such grackles have been

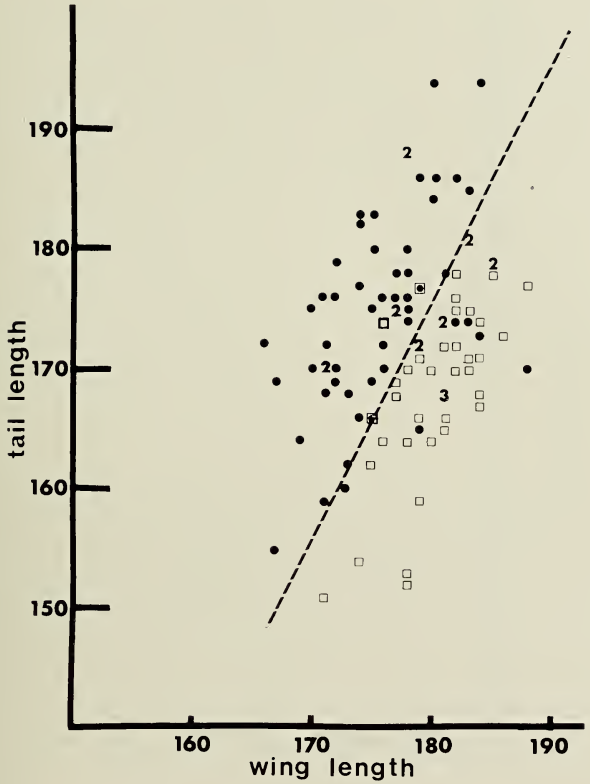

Fig. 6. Wing and tail lengths in males of *Q. m. westoni* (□) and *Q. m. major* (●). Numbers to the left of line represent *major*, those to right represent *westoni*.

collected, and they are not clearly referable to any of the populations described above. One male that appeared pale-eyed in the field (TT 3489) had a pale peripheral portion of the iris measuring 0.7+ mm in diameter as opposed to pale peripheries of 1.0+ and 1.4+, respectively, in specimens of *alabamensis* and *torreyi* collected in their breeding ranges at the same time of the year.

The probability that there is a migration of Boat-tailed Grackles into coastal areas near Tallahassee is suggested by minor changes in the relative abundance of the species at different seasons of the year.

Cumulative data for September 1946 through August 1975 showed higher "frequencies" (birds per hour afield) for the months of September–March (3.3–4.4) than for April–August (2.7–3.6). Fall nesting of this species, although reported in south and central Florida (Kale, 1975; Riddell, 1976),

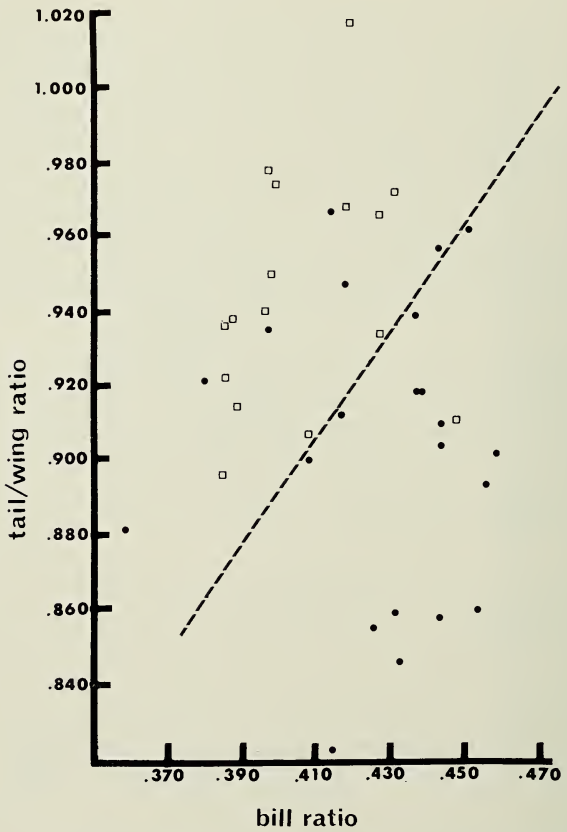

Fig. 7. Tail/wing ratios and bill ratios of pale-eyed males—*Q. m. torreyi* (●) and *Q. m. alabamensis* (□).

almost certainly does not occur along the northern Gulf coast. Most young of the species are on the wing by July, in which month a sharp increase of frequency was noted. Thus the fall increase probably reflects an influx of migrants.

Immatures

Although the results described above are based on adult birds, which were distinguished from first-year birds on the criteria of Selander (1958), it is interesting that my smaller sample of first-year specimens tends to support the same conclusions. Among males, for example, 6 specimens from Alabama and Florida are heavier than 5 from Texas and Louisiana (Selander and Giller, 1961), the respective means being 176.2 and 166.8 g,

and the only female *westoni* weighed 102 g, as against an average of 96.3 g for 15 females of *major* weighed by Selander and Giller. The 9 males from Alabama and Florida averaged lower in tail/wing ratio than the 5 Texas birds. The 5 females from Alabama and Florida were correspondingly lower in this ratio than the 15 from Texas and Louisiana. The 2 first-year females of *torreyi* have a higher average bill ratio than the 3 specimens of *westoni* and *major*. Three first-year males of *torreyi* have thicker bills (mean 12.3 mm) than 5 *westoni* from north Florida (11.5). Among the three more eastern races, however, the tail/wing ratio of first-year birds does not fully support the data derived from adults. Nevertheless, the facts that these immatures, even though small in number, generally tend to corrobaorte the differences found in adults strengthens the evidence of valid morphological distinctions among the four populations.

Taxonomic Status

Are the differences among the four populations distinguished here sufficently large to warrant subspecific recognition? Mayr, Linsley, and Usinger (1953) defined subspecies as "geographically defined aggregates of local populations which differ taxonomically from other such subdivisions of a species." There can be little doubt that the four populations of grackles meet the first of these criteria, as the breeding range of each is separated from that of the next-closest population by a hiatus of at least 55 kilometers. It has also been shown that they differ taxonomically (i.e., morphologically), the only question being whether the *degree* of the difference is sufficient in each instance. Among the requisite degrees of difference that have been used in describing subspecies now accepted in the A.O.U. Checklist are the following: (1) 90% of the individuals of one population differ from 90% of those in the other, (2) 75% of one differ from 100% of the other, or (3) 75% of one differ from 75% of the other. Probably the last of these criteria is too liberal for any two populations whose ranges meet and produce a zone of intergradation, thereby greatly increasing the number of individuals that cannot be assigned to a given population. In the four populations of Boat-tailed Grackles, however, the birds that are morphologically similar as to iris color are widely separated from one another, with a race of contrasting eye color occupying an intermediate range. Both in eye color and probably in other characteristics, the light-eyed populations are subspecifically distinct from the dark-eyed ones (see pp. 31–32). Because the pale-eyed *Q. m. torreyi* and the dark-eyed *Q. m. major* are the two races presently, and justifiably, accepted, the only remaining question is whether each of these should be regarded as a single subspecies or consists of two subspecies as described above.

The case for nomenclatural recognition of *Q. m. alabamensis* is relatively

strong. In both sexes, the tail averages longer than in *torreyi* and the wing shorter, making for a markedly greater mean tail/wing ratio. In Figure 4, tail length is plotted against wing length in males and a sloping line arbitrarily drawn to give the maximal separation into the two forms; 21 specimens of *torreyi* (75.0%) lie to the right of this line and only 7 to the left. Reciprocal figures for *alabamensis* are 14 (82.4%) and 3. Females proved even more distinctive for this combination of characteristics—*torreyi*, 17:2, and *alabamensis*, 15:1. Also in *alabamensis* the bill averages longer but not so deep as in *torreyi*, resulting in a lower bill depth/bill length ratio. When this ratio is plotted against the tail/wing ratio (Fig. 7; see also Table 4), 17 males of *torreyi* (77.3%) lie to the right of the line and only 5 to the left. Reciprocal figures for males of *alabamensis* are 15 (93.7%) and 1. (The smaller numbers involved in this comparison were due to the damaged bills of some specimens.) Basically the same data are presented for females in Table 5, showing that they are equally distinctive, if not more so (87.5% in *alabamensis* and 89.5% in *torreyi*). In this discriminant function analysis, it should be noted that the sample sizes are comparable—22 and 16 in males and 19 and 16 in females. Thus, based on this combination of characteristics, more than 85% of the individuals of one population can be distinguished from more than 85% of the other, except for males of *torreyi* (77.3%). I believe that these differences are an adequate basis for proposing nomenclatural recognition of *Quiscalus major torreyi* and *Q. m. alabamensis*.

The problem of distinguishing between populations of *Q. m. westoni* and *Q. m. major* lies chiefly in the relative similarity of the females. The results shown in Table 4 indicate that a high proportion of males in any population can be separated on the combination of tail, wing, and bill measurements. When wing and tail lengths are plotted for males of *westoni* and *major* (Fig. 6), 44 *westoni* (93.6%) lie to the right of an arbitrary line and only 3 to the left; reciprocal figures for *major* are 49 (89.1%) and 6. The student's *t*-tests (Table 3) also indicate four significant differences between these two races. These same sets of data show females to be less distinctive. When differences in weight in the two populations of dark-eyed males are also taken into account (p. 11) the case for distinctiveness in that sex appears even stronger, but more weights of females collected at the same time of the breeding season are needed to validate the apparent differences in that sex. Other than weight, the best characters for separating the dark-eyed females are wing length and tail length, and the combination of these will separate only about 70% of *westoni* from 70% of *major*. Therefore, the case for recognizing *Q. m. westoni* as a taxonomic entity rests on the relative distinctiveness of its males and the population's geographic separation from the other dark-eyed population.

Adult Specimens Examined
(Including specimens collected in fall)

Q. m. torreyi (55).—Delaware: 1, USNM. Maryland: 2, USNM. Virginia: 1, AMNH; 2, ANSP; 1, CM; 9, USNM. North Carolina: 3, USNM. South Carolina: 5, CH; 2, USNM. Georgia, 1, CH; 1, USNM; 1, UF; 3, UG. Florida: 1, AMNH; 1, CH; 5, FSU; 1, USNM; 14, TT; 1, USF.

Q. m. westoni (101).—Florida: 1, ABS; 1, ANSP; 7, CM; 1, CH (type specimen); 53, FSU; 5, UM; 11, USNM; 15, UF; 7, UMMZ.

Q. m. alabamensis (37).—Alabama: 2, AMNH; 1, CH; 3, FSU; 2, LSU; 6, USNM (including holotype and allotype); 15, TT; 1, USF. Mississippi: 1, CH; 5, TT; 1, V.

Q. m. major (156).—Mississippi: 1, USNM; 2, TT; 1, USF. Louisiana: 35, AMNH; 2, CH; 18, LSU; 15, USNM; 2, TT. Texas: 80, AMNH.

Q. major subsp. (7).—Florida: 2, CM; 5, TT.

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